SMITHSONIAN DEPOSIT

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

Publishing Office, No. 42 Pine Street.

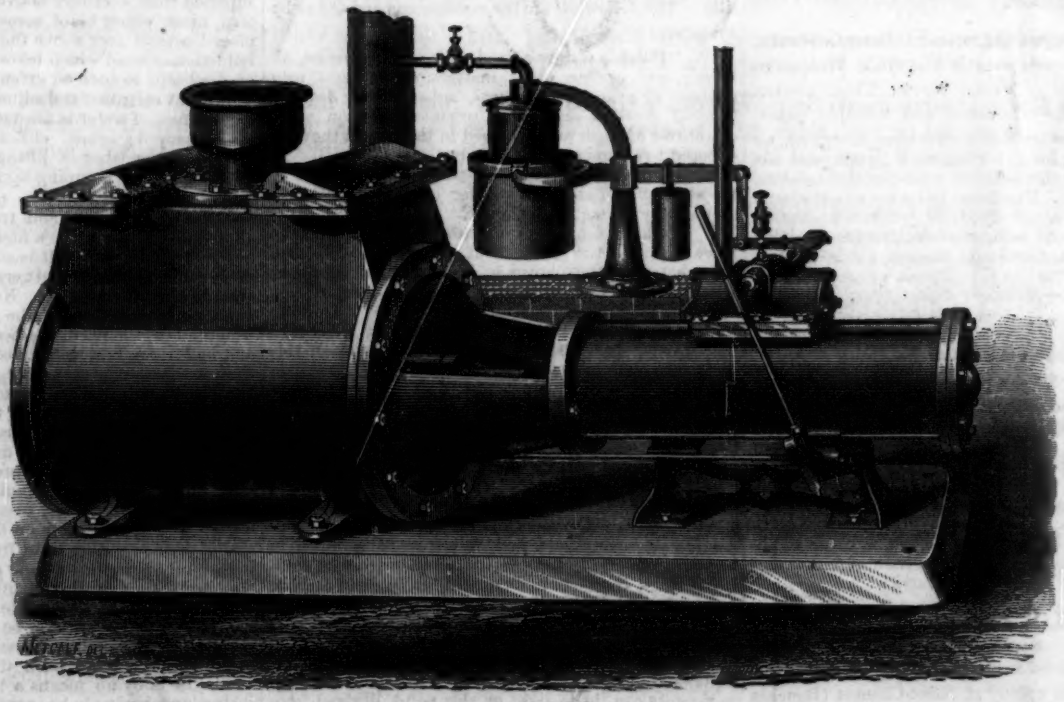
Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

VOLUME XV.—No. 9. WHOLE No. 254. | NEW YORK, THURSDAY, NOVEMBER 2, 1871. | $3 PER ANNUM IN ADVANCE.

Gas Exhauster.

The annexed cut represents a new Gas Exhauster, patented in this country by Messrs. A. S. Cameron and William E. Everett of this city, and which in point of cast, compass, and effectiveness, is a great improvement on appliances hitherto employed.

The instrument consists of a direct acting reciprocating engine, having two cylinders; the steam cylinder made according to the plan adopted in the well known "Special" steam pump. The exhausting cylinder is fitted with a piston and four simple valves, the motion of which produces the desired result.



CAMERON'S GAS EXHAUSTER.

The speed of the machine is controlled by the governor, which is plainly shown in the cut, and which is of the simplest possible character. By its operation on the throttle valve the machine is made to work fast or slow, according to the production of gas in the retorts, and keeping up a perfectly uniform condition of vacuum, which can be changed in a moment by simply moving the weight on the lever of the governor. The apparatus is so simple, that it can be placed and put in use by any intelligent mechanic; avoiding as it does the use of belts, gearing, and other complications hitherto employed in machinery applied to this duty. No engineer is required to take charge of it, and as there is not even a journal about the machine, it requires the least possible attendance.

Quite a number have been put in operation at different points throughout the United States, during the present year.

As this instrument becomes known, it must replace the more cumbrous and expensive exhausters hitherto in use. They are made of different sizes by the firm of A. S. Cameron & Co., foot of East 23rd st., N. Y.

Heating Illuminating Gas Before Combustion.

A writer in an English journal narrates as follows his experience in heating illuminating gas before its issue from the burner:

"About twenty-five years ago, I took out a patent for 'hot gas,' and made some elaborate and exhaustive experiments to ascertain its value and economy in practical use; the gas was heated by reducing a copper tube three-eighth of an inch to an oval section, and passing it over its own flame just near enough only to escape deposit of carbon. The temperature could not be less than 400 to 500 deg.; but this I did not ascertain. The trials were made with bat-wing, fish-tail, and argand burners; I found no practical economy when the pressure on the apertures of the burners reduced the flame to its proper and ordinary size, that is to say, if the nipple was consuming coal-gas at the rate of five feet per hour, only about three per cent. was saved when the same quantity of gas was being consumed in a heated state and with the same sized flame.

"If, however, the gas passing through the nipple was flickering or roaring when cold, I soon found that, as soon as it became heated, the flame gradually assumed a steady, bright, and brilliant form, and gave a shadow by from 25 to 30 per cent. better light for the same quantity of gas consumed; the same happened with either of the open burners; and in the argand, if the flame with cold gas was yellow and on the point of smoking, I found that, as the gas got gradually hot, the flame was reduced in height and its brilliancy increased fully 25 per cent.

"The conclusion I arrived at was, simply, that a much larger quantity of gas could be consumed (by an extra flow or pressure), with the same burner, in a heated than in a cold state; there is no doubt that hot gas more readily combines with the oxygen of the air, meeting it, as it does, ready for immediate combustion; hot gas, therefore, will be useful, where ligh only, and not economy in use, is the object sought for."

Lake Cochituate, which supplies Boston with water is said to be giving out.

Chemical Repertory,

No. 58.—November 2, 1871.
EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

88. Crenic and Apocrenic Acids contained in the Mineral Waters of Forges-les-Eaux (Seine Inferieure).—C. Boutigny.—This lengthy essay treats on the presence of proto-crenate of iron in the mineral water just alluded to, and on crenic and apocrenic acids. It appears that the acids alluded to are formed, in the instance of the water here mentioned, by the decomposition of organic (decaying vegetable) matter, while the iron is due in this instance to a vein of pyrites. The proto-crenate of iron is soluble in water, but that solution is instantaneously decomposed by contact with air, and hence an ochrey deposit is always found near springs, and in brooks and ditches containing the salt alluded to in solution, which salt cannot be obtained in dry pure state by any process. Crenic and apocrenic acids were first discovered by Berzelius in the water of Porla, Sweden.—*Academy of Sciences.*

89. On the Origin of Nitrates in Potable Waters.—Charles Ekin.—Being unable to account on the "sewage contamination theory," for the nitrates in certain potable waters, Ekin was led to examine certain fossilferous rocks of England, for combined nitrogen. He finds that grey chalk marl contains 1.1 parts of such nitrogen in 1,000,000 parts; Bath oolite, 1.3 parts; Green-sand fossils, 2.23 parts; Lias fossils, 3.6 parts; another sample, 4 parts; Fuller's earth fossils, nearly 3 parts; Inferior Oolite rock, 7.6 parts: another sample 9.9 parts. He also notices the significant fact that waters which had percolated through the Inferior Oolite, rising at its junction with the Lias, contained from 1½ to 2 grains of nitric acid per gallon; much more than those which rise at the junction of the Great Oolite and the Fullers's earth, where the strata are less fossiliferous. The bearing of these results on the "sewage contamination theory," is evident.—*Am. Chemist.*

90. Processes for Detecting, Distinguishing, and Separating from each other, Silk, Wool, and Vegetable Fibres in Mixed Woven Fabrics.—Dr. E. Kopp.—In this exhaustive and valuable paper, among some of the particular reactions described, we find the following for detecting wool in silk, and *vice versa*, based upon the fact that wool contains sulphur, while silk does not. The tissue to be tested—it should be, however, white, not dyed—is put into a solution of caustic potassa or soda, wherein, previously, oxide of lead has been dissolved; woolen fibres become black when immersed in this liquor, whereas silk remains unchanged.—*Moniteur Scientifique.*

91. On the Effects of Pressure on the Absorption of Gases by Charcoal.—John Hunter, M. A., F. C. S., F. R. S. E.—The experiments here detailed, were made with cocoa-nut charcoal, and with ammonia, carbonic acid, and cyanogen gases. The author concludes:

1st, that the amount of absorption increases with the pressure to which the gas is exposed; 2d, the same change of pressure produces about the same amount of increase in the quantity of each gas absorbed. He notices the fact that cocoa-nut charcoal absorbs a greater weight of cyanogen than of either ammonia or carbonic acid.—*Am. Chemist.*

92. Quantative Estimation of Nitrous and Nitric Acids in Rain-water.—M. Chabrier.—This essay contains, in tabulated form, the results of a series of experiments made chiefly at Saint-Chamas (Bouches du Rhone) it appears that, contrary to what is generally supposed to be the case, nitrous acid is far more generally present in rain-water than nitric acid, while nitrite of ammonia has also been found by the author; the quantity of nitrous acid in the litre of rain-water amounts to from 0.7 to 0.8 milligramme, the quantity of ammonia to from 0.30 to 0.35 milligramme, while of nitric acid only traces are found. Curiously, the quantity of rain which falls in the part of France above alluded to is the same as the quantity which falls in Paris, but in the former instance there are only fifty rainy days, to at least three times as many in the latter.—*Chem. News.*

[The *fact*, of the abundant occurrence of *nitrous* acid in atmospheric waters, was communicated to the writer by Prof. Schaeffer, Librarian of the U. S. Patent Office, as a result of his investigations, some 12 *years since.*—Ed.]

93. Application of Sodium as an Explosive Agent.—[F. Springmuehl has published an investigation, on a subject which some years since occupied the attention of the present writer. This relates to the explosive power that may be developed from the alkali-metals, by appropriate manipulation The present writer's especial device was the use of the liquid alloy of potassium and sodium, liquid at ordinary atmospheric temperatures, prepared by the original method of Gay-Lussac & Thenard (when they expected to get pure potassium, operating on an impure mixture of carbonates of potash and soda, whence arose their famous controversy with Sir Humphrey Davy, in which they claimed that potassium was fluid instead of solid). This liquid alloy is so much more energetic in its reactions with oxygenated liquids, than the solid alkali-metals, that no comparison can be made. The interaction of two *liquid* reagents is here in play, instead of that of a liquid and a solid, thus increasing the *vis viva* greatly, by diminution of the *time*. The experiments of Springmuehl are summed up by a contemporary as follows:—Ed.]

"The force exerted is by no means small, as may be inferred from the following: 46 grms. of sodium and 18 grms. of water yield 2 grms. of hydrogen, a bulk of 22,471.9 cubic centimeters. The space required for the sodium only amounts to 447 c.c. (the water is contained, previous to its coming into contact with the sodium, in a small bulb, which is solidly fixed by means of a neck to the bulb wherein the sodium is contained, which latter may be made of 50 c.c. capacity). Taking 50 c.c. for the capacity of the explosion bulb, the pressure of the gas generated inside will be 450 atmospheres, equal to 6800 lbs. to the square inch."

94. On the Development of Fungi in Potable Water.—E. Frankland., Ph.D., D.C.L., F. R. S.—This paper details at length the experiments made to test the truth of Heisch's opinion, that certain fungi in potable waters were evidence of sewage contamination. The following are the conclusions arrived at by Frankland:

1. "Potable waters mixed with sewage, urine, albumin, and certain other matters, or brought into contact with animal charcoal, subsequently develop fungoid growths and other organisms, when small quantities of sugar are dissolved in them, and they are exposed to a summer temperature.

2. "The germs of these organisms are present in the atmosphere, and every water contains them after momentary contact with the air.

3. "The development of these germs cannot take place without the presence of phosphoric acid, or a phosphate, or phosphorus in some form of combination. Water, however much contaminated, if free from phosphorus, does not produce them. A German philosopher has said, '*ohne Phosphor kein Gedanke.*' The above experiments warrant the alteration of this dictum to *ohne Phosphor gar kein Leben.*"—*American Chemist.*

95. New Contribution to the History of Graphite.—Dr. Berthelot.—In the first part of this very lengthy essay the author treats on the properties of the carbon met with in the Cranbourne (near Melbourne, Australia) meteorite; this carbon must be considered as having been first in a state of solution in molten iron, and to have separated therefrom on cooling. Next, the carbon obtained from oxide of carbon, by the decomposition of that gas by iron at a relatively low temperature, is considered. From the reaction of these substances, the author comes to the conclusion that native graphite, about the origin of which very little is known, is certainly not, at least as far as experiments can throw light on this point, derived from either anthracite or from decomposed masses of meteoric iron which contained carbon.—*Academy of Sciences.*

96. Illuminating Gas from Bones.—C. Elsig.—A reply to some queries of a correspondent made in Schilling's Journal. The difference in composition between spongy and compact bones is given as follows:

	Spongy bones.	Compact bones.
Organic matter	38.22	31.46
Phosphate of lime	50.24	58.70
Carbonate of lime	11.70	10.08

The bones average from one to two per cent. of fat.

In bone black there is usually about 20 per cent. carbon and 80 per cent. bone ash. Treatment of bones to extract the fat from them before burning not only gives a poor quality of gas when they are burned, but is detrimental to the purifying power of the black.

In the preparation of bone black much ammonia is disengaged, which is of great economical importance, if illuminating gas is prepared from it. Moistened lime only is necessary to purify the gas from the slight amount of carbonic acid in it. The writer concludes by remarking that an establishment might be conducted to manufacture illuminating gas and bone black suitable for refining at the same time, though the plan would necessarily vary in some details from that of ordinary gas works.—*American Chemist; from Schilling.*

British Association of Gas Managers, June 14, 1871.

[Abstracts, by the Editor of this Journal.]

[Continued from page 116.]

ON GAS MEASUREMENT.

By Mr. Hartley of Westminster.

There is yet another method of using the cubic foot bottle—namely, that employed by the gas examiners of London for testing experimental meters. A bottle illustrative of this method, was exhibited at the last meeting by Mr. Sugg, and a drawing of the apparatus appears in the published proceedings. The bottle terminates at each end with a glass tube, the lower marked to indicate the zero, and the upper marked to indicate the terminal point. The bottle is provided at top and bottom with suitable stop and vent cocks, and a pipe connects the lower part of the bottle to a water-cistern, while the upper part of the bottle is put into communication by means of another pipe with the instrument to be verified. Water is admitted at a regular rate through the lower cock, after adjustment to the zero line, so as give a uniform flow of air from the bottle, and at any desired or possible pressure. The arrangement is, undoubtedly, a very excellent one, and serves its purpose well, but it is attended with various disadvantages,—first, the meter must be supplied from a cistern above the bottle, and the cistern must either be of somewhat large area or be placed several feet above the bottle, as otherwise the reduction of head which takes place will affect the rate of discharge to such an extent as to render necessary a constant attention and adjustment of cocks; second, a cubic foot of water is needed for every cubic foot of air measured; hence, either much water must be wasted, or the labor of lifting or the more objectionable process of pumping up from a lower cistern resorted to.

These objectionable and troublesome processes are all avoided in the writer's method of using the bottle as a meter measurer. It is simply to interpose a well made wet governor between the air outlet of this transferrer and the meter No error can or does arise from the intervention of the governor. The latter is weighted to the needful extent, the bottle, governor, and meter are first connected together by pipes and their aeriform contents brought into equilibrium with the atmosphere. The instant the discharge of air from the bottle commences, the governor comes into action, and when the bottle is fully emptied of air, the gasholder of the governor descends and delivers the air which it has received, through the meter, and all once more comes into equilibrium with the atmosphere. This system has been severely tested by the writer, and appears both on the grounds of reasoning and of demonstration to be free from objections, while it certainly possesses strong claims on account of its simplicity, the small amount of trouble it demands, and the continued use of the same volume of water, which last may therefore be readily brought to and maintained at a due temperature. It is to be understood, however, that such direct measurement from the bottle is by no means a necessity in the case of a meter, and can only be readily applied to small meters. The method, moreover, does not give absolute accuracy, for the cubic foot of the bottle is a cubic foot under atmospheric pressure only; but the error is very small, inasmuch as under a mean barometric pressure, and with a meter or other measure opposing a resistance of so much as half an inch water pressure, the reduction in volume would be no more than 1–768th part, or just over ⅓ per cent.

The test gasholder is so well known that it is needless to describe it (there is a model before you), while it would simply be a waste of time to describe that, to you, familiar instrument, a wet meter. Nevertheless, the conditions which affect these instruments, and under which they can be made to measure accurately, may be fairly treated upon.

A gasholder of the usual construction is capable of measuring volumes of gas, while in a state of compression, equal to, exceeding, or in deficit of the atmosphere, these different states of compression being

obtainable by the employment of such a number of movable weights, acting in opposition to the weight of the holder, as will suffice to equipoise it exactly, or to dispose it to rise or to fall with any desired degree of force. As a theoretical proposition, it may be said that a gasholder is an instrument capable of measuring gas independently of pressure or friction, and that friction, in instruments capable of holding and measuring gas, tends generally to the compression of gaseous fluids.

A gas meter differs widely from a gasholder in its conditions of measurement. In a meter, friction, or resistance, is an essential element. A meter requires power to drive it; this power must be derived from the gas to be measured, so that the gas must be delivered into and pass through the measuring-chambers under some sensible pressure—that is, in a state of compression greater than that of the atmosphere, and can only be measured while in this greater state of compression. The practical effect of this has been shown to be small; but another important difference in measurement arises from the displacement of water from the measuring-chambers, which displacement increases as the working speed is increased, and renders the meter *slow;* that is, causes it to register *less* than the true volume passed through it. This fact leads to an important proposition—viz., What are the conditions under which a *test* or *standard wet meter* must be employed, in order to secure the closest approximation to true measurement?

If the capacity of the meter has been determined at its normal rate of working, and the water-level defined by marking the gauges when the meter is not working, and when only the atmospheric pressure is acting within it, then the meter must always be charged with water to the indicated level when open to the atmosphere; and it must always be used at its normal rate of working, or, if worked at other rates, the per centage of error due to such rates must be experimentally determined and allowed for. Practically, the error due to varying rates is not likely to exceed about *one per cent.*

If the capacity of the meter be determined at its normal or at any rate of working, and the water-line be defined while the meter is working at the same speed, and the pressure of the inlet gas be acting in the gauges, then the meter can be made to measure correctly at any speed, by the simple process of adjusting the water-line while the meter is working at the rate desired. More water will necessarily be needed in a meter when worked at a high speed, in order to provide for the difference in the levels within and without the wheel.

All large meters, to which gauges are affixed to indicate the water-level, should have the water-line defined while the meter is in motion. The advantages are, that an inspector could test a wet meter at any convenient or possible rate of speed, marking the "working line" while it was in action, disconnect his testing apparatus, set the tested meter in full action, and then add the needful quantity of water to make it measure correctly. Further, an inspection of the water-line when the meter was in full action, would at once show whether it was properly charged. The increased accuracy of registration on this system would in many instances possibly amount to 2 per cent. On the usual system the gas must be shut off from the meter before the water-level can be adjusted, causing at times much trouble and inconvenience.

In conclusion, the writer begs to submit the following as the most important points for the consideration of the members of this association:

1. The advisability of reverifying meters at moderate intervals, with a view to secure the more accurate registration of gas to consumers.

2. The desirability of extending the compulsory application of the Sales of Gas Act to the whole kingdom, so that disputes, etc., may be settled by appeals to local inspectors.

3. The propriety of urging on the Government the necessity of amending the Act, so that its provisions may include the verification of indexes, the use of the test-meter, and free scope for the exercise of the judgment of the inspector in the testing operations.

If it be thought desirable to seek for amendments in the Act, the representations of those interested will now have greater force than heretofore, in consequence of the recommendations made last year by the Standards Commission, which embrace some of the points herein mentioned, as well as others with which gas companies would do well to make themselves acquainted.

Mr. Kearny (Clonmel) speaking of the difficulty of ascertaining the true water-line in consumer's meters, said he thought it would be well if an external gauge or indicator were employed.

Mr. Warner said the idea of having an external gauge or indicator had been theoretically but not practically carried out. Some years ago there were several attempts of the kind, and Messrs. Hulett and Paddon had a patent for its use. Another modification of it was by Mr. Smith, who employed a pointer passing through a stuffing box on the front of the index. There were also several attempts made to put water-gauge upon the sides of the square front, but the gauge-glasses got broken, and it appeared that at the present time there were no practical means of indicating the water-levels. One point touched upon in the paper, which he as a practical man thought worthy the attention of the association, was the importance of the periodical testing of the meters, especially of dry meters. He had tested both kinds at intervals of about five years—that is, the company's meters; the consumer's meters he had been rather afraid of touching, because of the expense, but he thought it would have to follow very close upon the other. It certainly ought to be done once in about every five years.

Mr. D. Lane said if it were considered very desirable by gas managers or gas-meter makers to have an external means of determining the water-level in meters, the method employed for steam-boilers might be used, and that would get rid of the difficulty about stuffing-boxes, and the danger of gauge-glasses breaking.

Mr. Spice expressed his extreme gratification at listening to the able paper just read. He wished simply to make a remark on one point, and that was with regard to the objection to dry meters, or rather with reference to the difficulty of keeping them in perfect order. It had fallen to his lot to observe that meters, when applied to public lamps on the average meter system, had on close investigation produced results which were of the most startling character. The meter on one public lamp had recorded as the result of the year's working a consumption of 18,000 cubic feet, while another, which had given apparently the same light, recorded a consumption of only 6,000 or 7,000 feet, and this had gone into the average. Such varying results, under similar circumstances, created so much discontent in his mind that he obtained the insertion in the Chester Gas Act, 4 or 5 years ago, of a clause by which any meter during a portion of the quarter had ceased to register gas, should be excluded from the calculation altogether in determining the average results—whether such stoppage had been for a night, a week, or a month. The result was that the next meter, which had faithfully performed its duty, governed the 12 or 24 lamps as the case might be. Now it happened that a dry meter would occasionally stand still, and yet when taken down to be tested, the valve being started, it would be found to be perfectly correct in its measurement. This was a very serious matter for gas companies, and the difficulty was to see how this evil could be remedied. It had been said that if the meter stood still the lights would go out, but that was not always so. He had known instances in which the public lamps were alight, and the meter was was standing still, with both the valves partially opened.

Mr. Greenfield said he thought the same observation might sometimes be made in reference to wet meters.

Mr. Broadhead agreed with the writer that sufficient attention was not paid to the condition of the indexes. He had known cases in which they had worked backwards.

Mr. Miles thought the testing of meters had been too much neglected. He asked for an opinion as to how often 3-light meters should be watered.

Mr. Church felt bound to record his thanks personally to Mr. Hartley for his very valuable paper, and to acknowledge that, in his opinion, Mr. Hartley had been of the greatest possible service to gas engineers. He was a man who had investigated these matters thoroughly, and those who had the pleasure of his intimate acquaintance would be most ready to express their obligations to him. On this occasion Mr. Hartley seemed to have hit the blot, and to have shown most convincingly the defects in the present system of meter-testing. It was to be hoped the matter was now in the hands of individuals who would not be content till they brought it into a more satisfactory state. He was sure all present would agree with him that the existing mode left much to be desired on the part of gas companies. But though gas-meters, whether wet or dry, had their advantages and disadvantages, there could be no doubt they were most useful instruments. Those who had had some experience in meters knew well the difficulties which water companies had had in obtaining a meter which they could trust to, and he believed that up to the present time no reliable measurer of water, under both high and low pressure, had been brought before the public attention. He could recollect the time when gas was supplied to all consumers by contract; and yet with reference to wet meters, how very few improvements had been introduced since they were invented—the reason being no doubt that the principle of them was correct. He had found that wet meters after being in use for some years became slow, arising from the water-level not having been accurately taken. To get the accurate measurement of meters, the water-level must be taken inside the drum. If there was a gauge inside and out, it would be found that, when the drum became dirty or the friction was increased, from a variety of causes, a considerable difference existed in the level between the two; the fact being that there was the water friction inside the drum, *plus* the friction of the drum itself. He thought it would be an excellent plan (though it was a question of expense, which was important) that there should be a periodical inspection of all meters by a competent authority—say, once in five years, which would be quite sufficient. There was one thing which gas managers ought studiously to regard, and that was the necessity of having meters well made. If they went in for cheap meters they must make up their minds to have inaccurate meters. They ought to encourage makers to supply the best possible meters, and to be prepared to pay a fair price for them. He could state from his own experience that indexes were sometimes imperfectly made, and no doubt occasionally they became incorrect; but when the fact was considered of the thousands of meters which were turned out annually, it was marvellous that these errors were so exceptional. It was most desirable that provision be made for testing the indexes, as well as the other parts of meters.

[To be concluded.]

On the Destructive Distillation of Light Petroleum Naphthas, at Comparatively Low Temperatures.

By S. Dana Hayes, State Assayer of Massachusetts.

[Communicated by the Author.]

Under the generic term *naphtha*, as applied to some of the distillates obtained in the arts from petroleum, is included a series of hydrocarbons having specific gravities above 0·642, or between 0·625 (rhigolene) and 0·742 (heavy naphtha), and boiling points varying with the densities from 65 deg. F. to 300 deg. F. These naphthas have distinguishing characteristics by which they are easily recognized, and which place them in a class by themselves; and aside from their odors, densities, boiling points, volatilities, and solvent powers, a noticeable peculiarity is the absence of *oily* bodies; they do not leave any permanent stain on common writing paper that has been dipped in them, as do all the heavier and oily distillates obtained from petroleum. The redistillation of these naphthas under different conditions produces other hydrocarbons, in which the proportions of hydrogen and carbon are not only changed, but some of these products are *oils* that will stain writing paper like fats, and it is possible to produce crystallizable paraffine from these volatile naphthas by properly conducted distillations.

In the summer of 1861, the writer had occasion to redistill several thogsand gallons of light petroleum naphtha, which was entirely free from oily bodies, in cast-iron "stills," heated directly by coal fires and having powerful condensers attached, such as were then common in coal-oil refineries; and it was observed that besides the gases, light vapors, and a greatly diminished volume of naphtha, an unexpectedly large proportion of heavy paraffine oils was obtained; and after the distillations were finished, large masses of separated carbon were found in the stills, as in the ordinary destructive distillations of crude petroleum, or its heavy products.

In 1862, Prof. Bacon of Harvard Medical College, observed, when examining a sample of "keroselene," a light naphtha, that had a "specific gravity of 0·640 at 72 deg. F., and when heated in a flask containing scraps of platinum foil, began to boil at about 85 deg, F. As the more volatile parts distilled off, the temperature continued to rise, and at 170 deg. about three-quarters of the liquid had evaporated. It continued to boil freely, but the whole was not converted into vapor until the thermometer had risen considerably above 300 deg. It is remarkable that keroselene should be so readily and completely volatile at atmospheric temperatures. I found that keroselene and Squibb's ether, exposed in watch glasses, lost equal weights in two and a half and three and a half minutes respectively; and the former evaporated completely in about two-thirds of the time required for the other."

This peculiarity of petroleum naphtha has been so often observed in my laboratory, that I have learned to avoid the employment of heat when evaporating solutions, or extracts made in them, for the purpose of obtaining the substances dissolved; because, although these hydrocarbons are exceedingly diffusive, and evaporate entirely and very rapidly in the air at common temperatures, yet when heated above their boiling points (above 85 deg. F., in the case of keroselene), they undergo destructive decomposition, or, if in a flask, destructive distillation, heavier oily bodies being produced which are difficult to remove from the residuum of such evaporations.

Within the past year an apparatus has been erected in Boston, by Mr. Z. A. Willard, for generating gases and hydrocarbon vapors for use in metallurgical operations, that has offered an opportunity to obtain considerable quantities of the oils made from naphtha, dis-

tilled at temperatures below 300 deg. F., and I have examined these products with much interest.

Willard's apparatus consists of three or more upright wrought-iron cylinders, having a capacity of several hundred gallons each, standing near a common steam boiler, and which are connected together and with the boiler by pipes that enter at the bottom of each cylinder, ending there and starting out from the top of each again to connect with the bottom of the next; it is thus a system of large iron Woulfe's bottles, the first being connected with a steam boiler. These cylinders or gas generators, when in operation, are about half full of gasoline or petroleum-naphtha of the lightest and cheapest kind, which leaves no permanent stain on note paper, while steam at common working temperature and pressure is passing in at the bottom of the first cylinder, bubbling up through and vaporizing the naphtha, then passing into the other cylinders with the same action. The cylinders are provided with glass tube gauges, so that the changes occurring inside may be watched, and the whole apparatus and contents are maintained under a pressure of about fifty pounds to the inch when in operation.

In this apparatus the steam and naphtha vapors are held together in the upper part of the cylinders, above the liquid, under pressure, and at a temperature of about 212 deg. F., or much above the boiling point of the naphtha, but never so high as 300 deg. F.; and the decompositions occur in the vapors rather than in the liquid, light uncondensable gases and vapors passing upward, and heavy oil falling down into the naphtha below. The apparatus was operated continuously by pumping in naphtha at intervals as it was consumed, and after the heavy oil had accumulated it was drawn off at the bottom, the largest quantity being found in the first cylinder. It was found that the longer the vapors were held together in the apparatus, heated and under pressure, the more perfect were these decompositions; and Mr. Willard obtained at different times from two to ten per cent. of the naphtha as heavy oil.

The heavy hydrocarbon oil obtained in this way has a dark yellowish-brown color, and smells of the adhering naphtha when fresh; but after standing exposed to the air for a few days, it loses this odor and becomes nearly neutral, or comparatively free from offensive odor. Its specific gravity varies from 0·850 to 0·860, and its boiling point. after it is freed from the adhering naphtha, is above 400 deg. F.

It does not evaporate at common temperatures, leaves a permanent greasy stain on paper, is a good lubricator for machinery, and when redistilled at high temperatures, it breaks up into lighter and heavier liquid hydrocarbons, paraffine oil, like that of the same density obtained directly from petroleum, or its heavy products, by distillation.

When refining petroleum for illuminating purposes, it has been desirable to break up the heavier products and convert them into the light hydrocarbons generally known in commerce, in this country, as "kerosene"; and several forms of distilling apparatus have been devised for this purpose, in which the vapors of these bodies, by being heated above their boiling points, are decomposed or "cracked," first into burning oil and heavy products, and ultimately into burning oil entirely. But Mr. Willard's apparatus demonstrates that light petroleum-naphthas, and probably distilled naphthas from coal and other sources, may be "cracked" at a temperature below 300 deg. F. into lighter and heavier products, the latter being paraffine oils that belong to a class of hydrocarbons entirely different from that of the original naphtha.

Through the kindness of Prof. B. Silliman, I have received a copy of his report on the "petroleum from Venango county, Pennsylvania,"* since the first part of this article was written. It is a memoir that has never been published in any scientific journal, containing the results of an extended investigation made in the spring of 1855, being undoubtedly the earliest record of any chemical research on the distillations of this petroleum. And I take the liberty of quoting from it, because at this early date Prof. Silliman found that the products obtained from petroleum are not simply bodies previously existing in the petroleum, but that they are new substances formed by heat and distillation.

The author says: "The uncertainty of the boiling points indicates that the products obtained at the temperatures named above were still mixtures of others, and the question forces itself upon us, whether these several oils are to be regarded as *educts*, or whether they are not rather produced by the heat and chemical change in the process of distillation. The continued application of an elevated temperature alone is sufficient to effect changes in the constitution of many organic products, evolving new bodies not before existing in the original substance." And further on in the report: "The paraffine, with which this portion of the oil abounds, does not exist ready-formed in the original crude product, but it is a result of the high temperature employed in the process of distillation, by which the elements are newly arranged." When describing the properties of the illuminating oils distilled from this petroleum, Prof. Silliman states the result of an experiment as follows: "Exposed for many days in an open vessel, at a regulated heat below 212 deg., the oil gradually rises in vapor, as may be seen by its staining the paper used to cover the vessel from dust, and also by its sensible diminution. Six or eight fluid ounces, exposed in this manner in a metallic vessel for six weeks or more, the heat never exceeding 200 deg., gradually and slowly diminished, grew yellow, and finally left a small residue of dark brown lustrous-looking resin, or pitchy substance, which in the cold was hard and brittle. The samples of oil employed were very nearly colorless. This is remarkable when we remember that the temperature of the distillation was above 500 deg. F.

It is remarkable that in this early laboratory investigation Prof. Silliman should have noted the production of entirely new bodies by the destructive distillation of petroleum, such as are now only produced in large quantities in manufacturing operations. The "cracking" of petroleum, as a necessary result of its distillations in the large way, was not generally recognized or admitted for several years after this report was written, and even now there are many chemists who consider these as simply *fractional* distillations; but it is only necessary to mix the distillates together again and try to reproduce petroleum, to satisfactorily prove how different the products are from the original substance.

The petroleum upon which Prof. Silliman reported as above, did not yield any of the light naphtha to which I have referred, his lightest distillate having a specific gravity of 733, and a boiling point above 400 deg. Fah., probably because it had been floating on water exposed to the sun, or because it was thick "surface oil." Most of the petroleum, as now obtained from wells in Pennsylvania, yields by the first distillation, either by steam-heat or otherwise, about fifteen per cent of light naphtha, such as is commonly called gasolene, benzine, etc., which is entirely free from any greasy or oily constituent; and this light naphtha by distillation at comparatively low temperatures as described above, yields about ten per cent of its volume of heavy paraffine *oil*, a new substance produced by heating the vapors above the boiling points of the naphtha, and not simply an educt.

* Report on the Rock Oil or Petroleum from Venango Co., Pennsylvania, with special reference to its use for illuminating and other purposes. By Prof. B. Silliman, Jr. New Haven 1855.

Table of the Products of Coal Carbonized.

Realized by the Metropolitan Gas Companies (London) in the Year 1870.

Name of Company.	Coke per Ton of Coals in Bushels.	Breeze per ton of Coals, in Bushels.	Tar per Ton of Coal in Gallons.	Ammoniacal Liquor per Ton of Coals, in Gallons.
Chartered	21.86	2.60	9.32	18.77
Commercial	25.76	3.63	8.31	13.78
Equitable	24.07	2.56	19.85	22.86
Imperial	26.63	4.05	8.38	13.52
Independent	20.45	1.14	9.70	13.08
London	29.86	3.21	9.24	12.08
Phœnix	28.67	1.80	9.67	17.80
Ratcliff	23.58	2.79	8.96	19.55
South Metropolitan	24.66	5.10	9.07	17.38
Surrey Consumers	24.81	1.58	7.45	11.28
West'rn (cannel only	8.18	7.46	12.16	12.43
Average	24.44	3.33	9.14	15.60
Average, excluding West'n Co's	25.28	3.12	8.99	15.76

—*London Journal of Gas-Lighting.*

A Strange Phenomenon was observed at Delft last year during the operation of boring for water. H. Vogelsang has described that on August 3d, the iron tube had been driven to a depth of 17·5 metres through a bed of alluvium; when gas began to rush up the tube with great violence, followed by a stream of water. The foaming column rose 14 metres into the air, and played for 14 hours without intermission; it then appeared after intervals of nine minutes. The intermittent activity lasted till the 21st, and terminated with an evolution of gas alone. The water, when the irruption commenced, contained much iron in the form of carbonate, and had a temperature of 13 deg. Cent. The gas burned with a large but feebly luminous flame, and was composed, on the 6th of August, of 13·4 volumes of carbonic acid to 83·6 volumes of marsh gas; and on the 16th of the same month, of 11·6 volumes of carbonic to 88·4 volumes of marsh gas. On the 21st the tube was driven further, and at a depth of 30 metres a supply of water reached.—*Van Nostrand.*

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Eds.

Gas for Burner-Heating.

[In a letter from an old and valued correspondent, we have the following pertinent suggestions.—Ed.]

Cambridge, Mass., October 17, 1871.

Mr. Editor: * * * As a simple enquirer, I have taken some interest on the subject of heating gas-burners; and I desire to ask, strictly for information, whether the statement in the second column, page 116, of your abstract of the referees' report is correct; namely, that the heat (temperature?) of an ordinary gas flame is higher than that of a Bunsen burner flame, that is, 3,272° F. I had supposed that the latter was from five to seven times higher than the former. Certainly the heating power of a Bunsen burner in rendering an iron wire incandescent is much greater; though it is true, according to my experiments, that an ordinary yellow flame will raise the thermometer higher at the same distance than a Bunsen burner flame.

The whole subject of heating-burners needs attention, in my judgment, full as much as burners for lighting purposes. At least the time is rapidly approaching, I think, when gas will be so extensively employed for cooking and other calorific purposes, as to compel attention to the most desirable and safe form of constructing heating-burners.

Thanking you for the complimentary notice of my communication, I am, very respectfully,

Your obedient servant,

D. G. H.

The Chicago Gas Works.

Harrisburg, Pa., October 20, 1871.

Mr. Editor: In my opinion the great fire in Chicago has been a means of proving to the public, that gas works are not so liable to explosion as they are supposed to be. I was in Chicago shortly after the fire and could find no trace of an explosion, although the works had been running until the fire struck them. The holders are intact and could be put in use right away. The retort house stands, showing in reality that it was the only fire-proof building in Chicago; the machinery is uninjured, except the joints of condensers, etc., which the intense heat melted. The holders and works upon the north side are also uninjured, and I suppose are again working. All credit is due to P. T. Burtis, Esq., Engineer, who personally superintended the letting down of holders, etc., and was mainly instrumental in saving a large portion of the north side, by his presence of mind and energy, in cutting a space through piles of lumber, which had it caught fire, would have destroyed a large section of the city that now stands. He was nobly assisted by his brother, whose home was being destroyed at the same time that he was assisting to save others.

Yours respectfully, M.

On Improving the Quality of Gas.

Montreal, C. W., October 17, 1871.

Mr. Editor: I see by an address made by Mr. McGuire, President of the Cork Gas Company, at the general meeting of stockholders, that a mixture of coal tar and ground coal improved the quantity and quality of the gas, almost equal to the use of cannel coal. I also see by a report of the Dublin Gas Company, that they are using the same kind of mixture with equal success. And as all cannel coal is very expensive when imported into this part of the country, I would like to give the tar mixture a trial, but one of our practical chemists here says it would have a great tendency to throw off oily matters, etc., thereby stopping up our main pipes. Now, Mr. Editor, as the Gas-Light Journal is the principal source to get the best opinion from, I would like to get your own, and as many from gas engineers as possible, and greatly oblige,

Yours truly.

J. McE.

Meters: Mr. Gwynn, in Rejoinder to Mr. Keeling.

TIFFIN, OHIO, October 24, 1871.

Mr. Editor: I have been absent in the West, and my own letter as published, with the so-called answer of Mr. Keeling, did not reach me until the 20th; hence the delay.

I am quite content to be judged by your readers as to facts, and do not *now* intend to go over the same ground, for Mr. K. does not, that I see, meet a single point of mine, except one, where he says, "You know, or ought to know, *that all the testing a meter gets, is at the hands of the maker*, when it is in the best possible condition for the companies interest, * * * * all that is required next is to purchase a badge from an inspector, and attach the same to the meter—the meter is then complete; so that upon the meter maker rests the whole responsibility, whether the meter is a correct measure or not."

Mr. K. says further, that he is fully informed as to State Inspectors, etc., and yet has the effrontery to publish the above untruthful paragraph, and you, in exercising your privilege of Censor, shield him from the rebuke so richly merited.

Prof. Wormly, at Columbus, according to Mr. K., is not testing our meters, but sells the badge to the maker, etc., and so of other State Inspectors. You, Mr. Editor, as well as others, know *this is not so*.

I have done; unless you will permit my letters to appear without emasculation, for if I were to use any improper language, I am sure your readers would condemn, but I would rather *they* should judge me.

If permitted, I am willing to continue the discussion until the subject is better understood than at present, otherwise

I remain, respectfully yours,
JOHN GWYNN.

Subways for Gas and Water Pipes.

PARA, BRAZIL, Sept. 5, 1871.

Mr. Editor: I have really very little time to write, but I take advantage of this opportunity to state that Mr. Hyama, in his letter published in your Journal of February 2nd, relating to the subway for gas and water pipes in Southwark street, London, is not altogether correct in his statement, that the subway was actually in use for the purpose it was constructed, as the two water companies supplying the district, in conjunction with the Phœnix Gas Company, refused to make use of it for the purpose, and instead, went to the expense of opening the street, breaking through the concrete arch of eight to ten inches thick, and laying the pipes underneath, replacing the granite pitching at a very great expense, as by law the gas pipes must be placed a distance of four feet from the water pipes; a trench eight feet in width was made, in which the two series of pipes were laid at the proper distance. I write from personal knowledge, being at that time one of the Inspectors for the Phœnix Gas Company, and actually employed on this work. I have written for information upon the subject, and should it be of any interest, I will not fail to acquaint you of it. Yours respectfully,
ROBERT HUNTER.

On Gas Meters.

OTTAWA, CANADA, Oct. 21, 1871.

Mr. Editor: In Mr. Keeling's answer to Mr. Gwynn, on gas meters, in your Journal of October 2d, present volume, page 102, in his fourth paragraph in talking of testing gas meters he states, "to alter it would necessitate taking it to pieces." I beg to inform Mr. Keeling that I am a practical meter maker, and when I require to alter a meter for per centage, I do not require to take it to pieces. In a dry meter I have only to take off the top cover; in a wet meter I have only to take off the front cover. In his fifth paragraph he states, "that man who can make a perfect instrument, can also make the same a fraud." Let Mr. Keeling put before me a legitimate meter, either wet or dry, of any maker either on this side or the other side of the Atlantic, and he won't deceive me with his fraud; I will detect the slightest fraud at first sight.

In his concluding paragraph he suggests the introduction of the English Sale of Gas Act on this Continent. In the English Sale of Gas Act all meters are tested for per centage at five-tenths of an inch pressure only. Such meters, having the same capacity at two inch pressure, which is generally a medium street pressure, register as much as five per cent. and sometimes more against the seller.

The present dry gas meters are the only meters that can be made to obviate the variance of per centage according to pressure. Yours respectfully,
WILLIAM REEKIE.

How to Test Kerosene Oil.

NEW YORK, 37 PARK ROW, Oct. 25, 1871.

Mr. Editor: Allow me to correct a statement made by you at the close of an article under the above head, on page 119 of your valuable journal, in which my test of petroleum is described; namely, the statement that "instruments for this purpose, founded on this principle of the tension of vapor, have been for some years in use here"; and further that "we owe the first application of this kind to Prof. C. A. Seely of this city."

The facts are these: Considering the great danger of applying the usual fire test in a store containing many barrels of petroleum, and consequently inflammable vapor, and the consequent necessity of testing every sample in a locality situated at a safe distance, I was many years ago satisfied that it was totally unnecessary to apply the flame to any gas which is evolved by heat from petroleum, kerosene, etc., as all the gases rising from hydrocarbons are combustible; therefore we have only to ascertain if there is any gas evolved at any given temperature, which operation is easy enough performed by heating the oil contained in a little bell jar or inverted test tube, by plunging it in water heated to the temperature desired, by mixing cold water with hot water, kept on hand in a bottle previously boiled.

I secured the priority of this idea at the Patent Office, not because I saw much profit in it, but simply for the sake of obtaining due credit for this little scientific application, in case it was ultimately found useful. In the meantime I inquired in a great many petroleum distilleries, from dealers in oils, and among scientific men, if ever any one had suggested the idea and brought it in practice, but I found that it was positively new; and I can assure you that even now it cannot be said to be in use, and surely instruments for this purpose cannot be obtained. I dare even say that they do not exist, except a few of my own, made according to my patent specification. The one figured in the *Scientific American*, from which you derived your information, is totally worthless. It was only made up from a defective report in a daily paper, as I will show when publishing the correct form in a short time. These instruments were made by me in the spring of 1869, when among other acquaintances to whom I happened to communicate the principle, in the succeeding summer and fall, I remember Prof. Seely, for this reason, that a few weeks after my communicating to him my new idea of applying the so-called fire test to petroleum, I saw in one of the dailies a report published of the Lyceum of Natural History, which mentioned that Prof. Seely had described to that body the principle of the very same petroleum test I had explained to him a few weeks previously. If he had given me credit for it it was not mentioned, but I cannot suppose that he neglected this duty.

My patent was granted (after an intentional delay on my side, in not completing the application before I had thoroughly tested the process, and compared it with the usual tests) in the winter of 1869–70, and issued June 6, 1870. Different other investigations of various nature, and many other matters, have however prevented me from taking steps to its introduction, notwithstanding that more than a year ago a very favorable allusion was made to it, in one of the reports of the United Fire Insurance Companies. I brought the apparatus lately before the Scientific Association in Indianapolis, from the report of which the *Scientific American* took their notes, giving me due credit; but for want of proper drawings, originated the very defective form mentioned before.

I would never have risked bringing this matter to the attention of the Association, if it had not originated with me, and had "been for some years in use;" but it proved new to the members of that well-informed body. The Patent Office recognized the same fact by granting me the patent nearly two years ago; while in addition to this I can prove my priority by witnesses of the highest standing in New York.

Yours respectfully,
P. H. VANDERWEYDE, M. D.

NOTE BY THE EDITOR.—The impression on our mind being that we had conversed with Prof. Seely on this subject, at periods antecedent to the dates given by Dr. Vanderweyde, it seemed to us that the latter gentleman may be misinformed. Being unable, however, to recall to mind anything very definite, we thought it proper to submit the matter to Prof. S. To him we are indebted for the following statement of his view of the fatcs.

NEW YORK, October 30, 1871.

Mr. Editor: It was in 1862 that I first devised and constructed instruments on the principle of the tension of vapors, for testing volatile burning oils. In the fall of that year two or more of my instruments were on exhibition at the American Institute, and during the winter of 1862—3 I assisted several times at discussions before the general public, of the theory and construction of such instruments. The invention was well known and was much talked about in 1863. But the wiseacres of the Institute, and especially a committee of its heavy weights, did not appreciate the relation between the explosibility, volatility, and tension of vapors of burning oils, and voted for the instruments which operated with a flash and a pop. A record of these things will probably be found in the transactions of the Institute.

In the number of the *Am. Artisan* of Feb 7th, 1866, page 212, appeared a short paragraph of the purport that M. M. Salleron and Urbain had just communicated to the Academy of Sciences a paper on the testing of oils by instruments constructed on the principle of the tension of vapors. In reclamation of my rights of priority, the *Artisan* published a letter from me in its issue of Feb. 2Ist, 1866, page 246, and in that letter my case, as it then stood, was pretty plainly stated. The French instrument, a printed description of which, by the way, did not appear till 1868, was almost identical with one of those which I had constructed in 1863. An illustrative description of the Salleron and Urbain instrument may be found in a French translation by Gautier, of Bolley's *Handbuch der Technisches Chemischen Untersuchungen*, Paris, 1866, p. 537.

During the years 1868 and I869 the Fire Department and the Board of Health of this city instituted legal prosecutions on a great scale against dealers in burning oils, for ifringing an ill-considered law relative to a certain fire test. In these suits I was employed as scientific expert on the part of the defence, and in that capacity I advised that the instruments relied on for testing oils as prescribed by the law, were indefinite, fallacious, and untrustworthy. For this and other reasons, the prosecutions were finally abandoned. The prosecutions had stimulated a considerable interest in the matter, and it seemed a fitting occasion to bring on a discussion among the scientists of the city. It was in such circumstances that on Dec. 13th, 1869, I read a paper before the Lyceum of Natural History, entitled "On tests for the dangerous qualities of burning oils."

I do not remember to have had any conversation with Dr. Vanderweyde at any time about the tests of burning oils. Hundreds of my acquaintances have discussed the subject with me, and I would think it likely that the doctor was one of them—except for the fact that such an interview would be quite inconsistent with the history of the invention which he has furnished you. CHARLES A SEELY

Report to the Board of Trade by the Gas Referees on the Ammonia Impurity in Gas.

[Condensed by Editor of this Journal.]

TO THE LORDS OF THE COMMITTEE OF PRIVY COUNCIL FOR TRADE.

On and after the 1st of October, 1871, the maximum of ammonia allowed in gas will be reduced to two and a half grains per 100 feet.

From tabular statements given of the amount of ammonia found in the gas of all the London companies, from August 1869 to March, 1871, it appears that although the maximum allowed has hitherto been five grains per 100 feet of gas, the average amount of ammonia in the gas of all the companies has been greatly below five grains. At the Blackfriars works the gas has been manufactured without any ammonia at all. At the works at Fulham, at Bow, and in the Old Kent Road, the gas contained on the average less than one grain. At the works at Haggerston and St. Pancras (where there is a lack of room), the ammonia in the gas has averaged from 1·5 to 1·8 grains; and in the gas works at Westminster, Brick Lane, and Curtain Road, which are the oldest and most cramped gas works in London, the average, though much higher than at the other works, was well below the maximum, being respectively 3·5, 3·5, and 2·6.

There has, therefore, been a marked improvement in the purity of the gas as regards ammonia, since the Act of 1868 came into operation.

AMMONIA PURIFICATION.

The process of purifying gas from ammonia consists mainly in bringing the gas in contact with water, which has a remarkable affinity for ammonia; water

being capable of absorbing fully 700 times its own volume of ammonia. And the most perfect process of ammonia-purification is that which does its work with the least amount of water: First, because when much water is used, it tends to absorb a portion of the hydrocarbons which constitute the light-giving element of gas; second, because the ammoniacal liquor so formed is too weak to be saleable in that condition; and third, in consequence of this, the "liquor" has to be returned into the scrubbers several times to bring it up to the required strength, whereby the impurities with which the water is charged are again brought in contact with the gas.

In many provincial gas works the ammonia-purification is effected by "washers," an apparatus in which the gas is made to pass or bubble through water; in some other gas works the process in use may be described as a shower-bath, where the gas passes up through a descending shower of water. Both of these processes are defective in this respect, that the gas is never brought in contact with clean water, the "liquor" being kept in the washers, and returned into the shower-bath apparatus, until it is brought up to the saleable strength; an arrangement which, as a'ready said, is objectionable, inasmuch as the water a sorbs, besides ammonia, sulphuretted hydrogen and carbonic acid; and all these impurities, being volatile, are liable to be given back into the gas. It is true that the same system of returning the "liquor" into the apparatus until it acquires a saleable strength generally prevails also where scrubbers are used; but the difference is that with washers, and in the shower-bath apparatus, this system is indispensable, whereas it may be wholly avoided if a perfect kind of scrubber is used. Moreover, in almost every case where scrubbers are used, the gas is brought in contact with clean water in the last scrubber of the series, thereby cleansing the gas to an extent which is impossible to do in washers.

A minute division, also, both of the water and of the gas is of paramount importance in ammonia purification, for the absorbent power is confined to the *surfaces* exposed to its action. Even in scrubbers the minute division of the water is sometimes too little attended to, the water being passed through the apparatus in excessive quantity, in fact in streams; w th no improvement as regards ammonia purification, and with disadvantageous results to gas companies as regards economy and convenience. The more finely or minutely the water is divided in the scrubber, and the more equally distributed over the scrubbing material, the more efficient is the process of ammonia purification.

The scrubber consists of a tall iron cylinder, filled with pieces of insoluble material, down between which the water percolates, in such a manner that it is brought gently and at all points in contact with the ascending stream of gas. The material with which the scrubber is filled may be of various kinds. The material most generally used is coke, which is the cheapest (indeed costless, because the coke when "foul" *i. e.*, thickly coated with tar, can be used in the retorts, or in some works as fuel in the furnace), and also gives excellent results owing to its porosity. The gas does not indeed pass through the pores of the coke, but the surface of this material being full of small cavities, the water lodges therein, and thereby comes in contact with the gas in a better manner than when brick or stone is used; but as soon as the surface of the coke becomes coated with tar, the peculiar advantage of this material is lost. Another kind of scrubber is one filled with tiers of thin deal boards placed on edge, over the surfaces of which the water drips, and the ascending gas is purified by coming in contact with those wetted surfaces. A scrubber somewhat similar, but less effective, consists of horizontal shelves of wood, so constructed as to keep their upper surface always covered with water to the depth of about a quarter of an inch—the water absorbing ammonia as the gas passes over it.

[To be continued.]

The Dublin Gas Works.

[Prof. W. H. Chandler, of the *American Chemist*, gives us the following valuable and highly interesting account of a recent visit by him to these works. We must add that Prof. C. certainly underrates the average daily consumption of gas in this metropolis. We shall present some comparative figures under this head soon, of numerical relations of population to consumption of gas, which will have great interest.—Ed.]

Coal gas is much more used in Great Britain than in the United States, and whereas in our country it is an expensive illuminating agent, on the contrary it is, in the former country, one of the cheapest sources of light, selling for from three to five shillings per thousand feet. Throughout Ireland, so far as I have noticed, every village has its gas works, and although of course the poor people burn tallow dips, yet to the better classes gas is available. Comparing Dublin with New York we find the former city, of 250,000 inhabitants, consuming 4,000,000 feet per day, whereas in our own metropolis, of certainly 1,000,000 people, not more than 8,000,000 feet are used in the same time. The cause of this low price of gas is the cheapness of the labor in the mining and transportation of the coal, in the building of the gas works and the manufacture and distribution of the gas; in fact in the production of every article employed and in every department in the management of the establishment. Good gas coals can be obtained for about $3.50 per ton; ordinary laborers for from 50 to 60 cents per day, and skilled laborers, such as machinists, carpenters, masons, etc., for not more than $1.50 per day.

The Dublin gas works is one of the best managed works in Great Britain, and we find there several points of interest. The clay retorts are set in benches of nine, and closed with the self-sealing doors, which have machine turned edges, and, being attached to the retort by hinges, are brought in close contact with the iron facing of the retort, also perfectly true, by means of an iron lever. The doors are thus closed gas-tight, without luting, thus saving the expense of the latter, as well as the cost and delay in handling doors, as with us.

The steam stoker is employed and with two of these machines and eight men, 540 retorts are charged and discharged, the retorts being worked in six-hour charges, the men working twelve hour relays. The machine empties three retorts at a time, by means of as many long rakes, which are thrust into the retorf and rake out the coke, which falls through an opening in the floor into the iron wagon. Three scoops, filled from a hopper with coal, are then moved into the retorts, overturned and withdrawn. There are three men upon the machine, one controlling the steam, one the valves that fill the scoops, and one the movements of the rakes and scoops. A fourth man stands upon the floor to sweep up whatever may fall thereon during the operation. This is certainly the most expeditious working of retorts I have ever seen.

McKenzie's patent mixture of coal and coal oil was formerly employed at the Dublin works. It is now, however, abandoned. In place of this, the coal is coarsely pulverized in a Chilean mill and mixed with the coal tar, produced upon the premises. This mixture is quite dry and is found to work well. After a time the coal tar from this process fails to yield any gas, when it is sold to a patent fuel company in Wales. A portion of it is also consumed upon the spot in making a patent fuel with the coke breeze, which is thus cemented into cylinders of four inches diameter and one foot length.

Some year or two since, the city compelled the works to adopt the iron process, and for purifiers the engineer adapted two disused gasholders. At the bottom, one and one-half feet in depth of lime is placed and then, supported upon as many trays, six layers of a mixture of bog iron ore and sawdust, each layer one and one-half feet thick, and finally another layer of lime. The purifier works well, delivering gas containing 20 to 25 grains of sulphur and one per cent. carbonic acid, and with a moderate pressure. This use of the layer of lime confirms a previously-formed opinion of the writer as to the benefit of its employment in the iron process of purification'

To re-enumerate therefore the noticeable peculiarities of these works we mention the self-sealing retort doors; the steam-stoker; the use of the mixture of coal and coal tar, thus as it were, consuming the coal tar upon the premises.

The two enormous purifiers, formerly two gasometers, and a depth of nearly ten feet of purifying material therein.

How to Judge the Quality of Petroleum.—Good petroleum should have the following characteristics:

1. The color should be white or light yellow, with blue reflection; clear yellow indicates imperfect purification, or adulteration with inferior oil.

2. The odor should be faint, not disagreeable. The specific gravity at 60° Fah., ought not to be below 0.795, nor above 0.84.

3. When mixed with an equal volume of sulphuric acid of the density of 1.53, the color ought not to become darker, but on the contrary, lighter.

A petroleum that satisfies all these conditions, and possesses the proper flashing point, may be set down as a pure and safe article. To test the color, care should be taken to select a glass bottle of good quality, perfectly white and clear.—*Ironmonger.*

RECENT AMERICAN PATENTS.

Pertaining to the Specialties of this Journal, for the three weeks ending October 28, 1871.

119,454.—Water Gauge.—M. Doyle, Baltimore, Md.
119,455.—Gas Lamp.—G. S. Dunbar, Pittsfield, Mass.
119,478.—Gas Burner.—G. E. Smith, New York city.
119,480.—Gas Burner.—W. B. Stofer, Memphis, Tenn.
119,492.—Gas Light.—A. N. Allen, R. H. Dewey, Pittsfield, Mass.
119,561.—Lighting Gas Jets.—A. L. Bogart, New York city.
119,586.—Gas Retort.—H. H. Edgerton, Fort Wayne, Ind.
119,663.—Gas Machine.—T. G. Spinger, Fayette City, Pa.
119,709.—Water Meter.—H. J. Hyams, Pittsburgh, Pa.
119,714.—Water Meter.—A. O'Leary. Iowa City, Iowa.
119,720.—Hydrocarbon Burner.—A. C. Rand, Chicago, Ill.
119,556.—Water Elevator.—S. Randall, Providence, R. I.
120,058.—Gas Lamp.—J. Gray, New York city.
120,082.—Lighting Gas.—E. D. McCracken, New York city.
120,083.—Lighting Gas.—E. D. McCracken, New York city.
120,114.—Chandelier.—E. M. Smith, New York city.

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Respectfully Yours,
H. A. Allyn,
Superintendent Brookline Gas-Light Co.

East Boston, June 15, 1871.

Gentlemen: We have used your Screens some five years they give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen.

Yours truly,
A. M. Norton,
Supt. East Boston Gas-Light Co.

Chelsea, May 1, 1871.

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We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly,
John Andrew, Supt.

Jamaica Plains, Mass., June 21, 1871.

Edward Duffee, Esq:

Dear Sir: The Trays ordered by this Company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige. Yours truly,

James F. Rogers,
Supt. Jamaica Plains Gas-Light Co.

Also see letter from Providence, R. I., in another column.

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*** Reference to them is requested 204-1y

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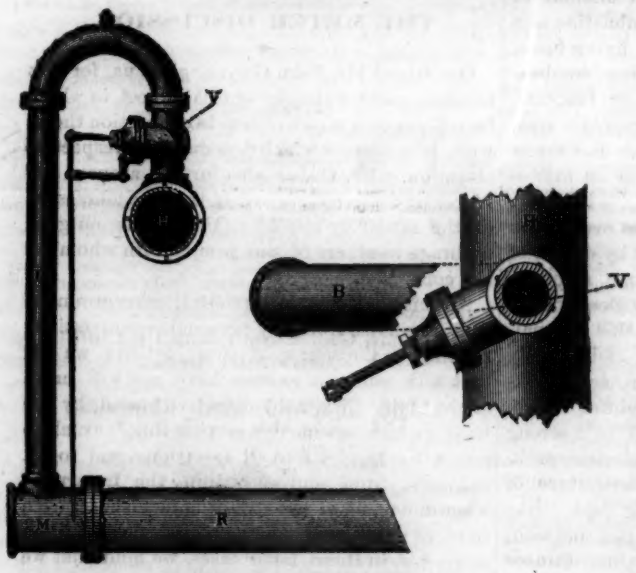

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GAS-LIGHT JOURNAL

AND

Chemical Repertory,

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PROPRIETORS.

EDITOR—PROF. HENRY WURTZ.
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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

THURSDAY, NOVEMBER 2, 1871.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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TO OUR SUBSCRIBERS AND PATRONS.

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General Editorials.

BURNERS FOR HEATING PURPOSES.

The Reverend Mr. Haskins, of Cambridge, places us still further in his debt, in this number, by again suggesting a subject of practical and prime importance for our consideration. It might strike some that this is not exactly the season to awaken interest in this topic; but we do not think so. The introduction of gas-heaters, for purposes merely calorific; for warming sleeping apartments, bathrooms, offices, and so on, where heat is required but for transient periods, without paramount regard to economy; is gaining headway, and, as we concur with Mr. H. in thinking, is destined to furnish in the future, a great item of consumption. Our inventive readers could not, we believe, busy themselves with a more profitable subject for successful invention, and this is just the season of the year to bring forward improvements under this head.

The question regarding the temperature of the flame of the Bunsen burner, we shall answer according to the best of our ability. First of all let us remember that the *maximum* temperature, intensity, or (as we should prefer to call it) *vis viva*, or living force, of a burning gas, has no *necessary* connection with the total amount of heat produced by the complete combustion of a given quantity. In production of living force, energy, or in other words temperature of combustion, *time* is a necessary element or function. The less the time, that is, the more *rapid* the combustion, the higher the temperature. For example, burn a jet of hydrogen slowly in an atmosphere of oxygen. It burns *completely* to water, without evolution of much light, and production of 34.462 units of heat for each unit by weight of hydrogen. Now modify this same reaction, after the fashion first discovered by Doebereiner in 1831 (as has been shown by us; this Journal, vol xiii., page 51; August 16, 1870), and recently rediscovered, after being forgotton, by Frankland; that is, enclose the same weight of hydrogen with its equivalent of oxygen in a strong globe and flash it all at once by the electric spark. The far greater intensity and temperature of combustion are shown by a blinding flash "like the most vivid lightning"; and this notwithstanding that, as Deville, Debray, and Bunsen have shown, but about *half* the mixture can be made to burn under these conditions by one spark. If we compressed the gaseous mixture into half its volume or less, so as to approximate to the production of the full calorific equivalent, probably no glass globe could be made to endure the force.

Another simple illustration can be drawn from the relative effects of a pound of gunpowder burning in a long train, and inside a shell. Now, according to the best experiments that have been made, supposing the combustion of one cubic foot of coal gas, in the one case from an illuminating burner, and in the other from a Bunsen or other non-luminous burner: the total heat in each case is the same, that is, the same amount of water can be heated from the freezing to the boiling point, and the same weight of steam made. The observation cited by the referees amounts but to this; that there is, in a flat flame burner, a particular zone or shell of the flame in which the combustion of some constituents of the gas proceeds with such rapidity as to produce the temperature necessary to melt platinum, while no such fusion can be accomplished in any part of the Bunsen flame. Mr. H. will find the experiment recited in a previous part of our abstract (issue of October 2, page 101, middle column). By the way, it is curious that this hottest zone of the flame is *not* a luminous zone, but, as they assert, a *blue part*; thus showing that the hottest and lightest parts of such flames are not coincident, as some have maintained, with apparent reason.

(As to the platinum wire fusion experiment, we are a little surprised that the referees have brought it forward as new. We have been familiar with it ourselves for twenty years at least, and have used it numberless times as a rough and easy test of the quality of gas; as the gas must generally be good, and we may add, the wire as fine as a hair, to produce the result. It is nevertheless true that we have never met with it in print before, and have not found the many chemists to whom we have shown it to have been previously aware of the fact.)

As in heating apparatus, for apartments at least, apart from cookery, etc., high temperature is not only not necessary, but rather objectionable; the other advantages of the Bunsen and other lightless burners, render them probably preferable, in the former case at least. We hope that our reverend correspondent will not rest here, but will give us his views on these interesting topics further; and we solicit the experience also of others, on this head.

THE METER DISCUSSION.

Our friend Mr. John Gwynn gives us, for this number, another chapter of this subject, in which he reflects on our own course in connection therewith, in a manner which demands our respectful attention. Mr. G. has also further aroused our regret by telling us privately that the admission of the initiatory articles in this discussion gave umbrage to others of our friends with whom he has conversed.

All this we deprecate, on the following grounds: If it originates from any personal considerations relating to the source of these articles, we say that with such we neither have, nor will have, aught to do. We hold ourselves bound, by the trust we have assumed in editing this Journal, to give a *hearing*, both to all assertions and to all opinions, from sources within the fraternity, when the name of the author is furnished; even in cases where we ourselves wholly dissent; and moreover, in these latter cases, we hold that we are not ourselves necessarily bound to join in the discussion, but rather that all parties will be better satisfied, in general, if we keep out of it, and leave the field of discussion to those who are constantly occupied with these subjects in a more *practical* way than we can be.

Further, if it be claimed that the attacks which furnished the occasion for this imbroglio, affect the whole gas fraternity, and are vexatious and injurious thereto, and should therefore be excluded from our columns; without making any admission, or committing ourselves as to this, in the least; let us allow, for the sake of argument, that it is true. *Qu'importe?* Why simply this, and thus; that such attacks, if excluded from our columns, where they can at once be met, if necessary, and frustrated, if possible, would then naturally find their way into the general secular press, where they would reach large circles of already prejudiced readers, wholly beyond the reach of any of us, and thus become "stabs in the dark," against which we should be almost wholly defenceless. It is clear therefore that, by furnishing a channel for this kind of discussion, appropriate thereto, we are doing a good work

for the gas interest; and we moreover claim thanks for having elicited the fact that there *are* in our country gas men of distinction, like Mr. G. and others, who will deign to join in useful discussion on practical points. That the meter question is beyond controversy, is an opinion not indulged in by eminent experts in the mother country; as illustrated by the remarks we publish in this issue on Mr. Hartley's paper on Meters, before the British Association of Gas Managers last June.

One more remark, personal to Mr. G. As he has made the solemn appeal from us to our readers, to a tribunal which we of course recognize as a far higher one; and as he thus discharges us of all responsibility, we shall perforce hereafter pretermit all censorship whatever in his individual case, even when involving *rebuke* of an opponent; and leave our readers to judge. We trust he will continue the discussion on these terms, as proposed by himself.

WORKING THE TAR OVER AGAIN.

On another page will be found a letter from the Superintendent of the Montreal Gas Works, in which he asks our opinion respecting the plan of working over the tar, ground up with coal, in the retorts, as in Dublin, Cork, and probably elsewhere. We must endeavor therefore to give Mr. McElroy an opinion on this subject, at least equal in value to those of Jack Bunsby. We observe that Prof. Chandler, in his account of his visit to the Dublin Works, on another column of this issue, refers to this matter. With some modifications, we concur with Mr. McE.'s "practical chemist." Tar, thus used, would doubtless evolve much tarry (as well as oily) vapors, together with vapor of *naphthaline* and similar substances, with much soot; which would tend strongly to obstruct the stand-pipes, possibly the main pipes. If much troubled with choked stand-pipes already, we certainly could not advise Mr. McE. to work in this way. However, we must add, in the words of the eminent mariner above referred to, "the bearings of this observation lays in the application on it." Methods have recently been devised, and are now coming into use in some places, among us, which appear to promise entire relief from the difficulty of choked ascension-pipes. Some of these we hope shortly to be authorized to bring before the gas public.

We should think it might be worth while for Mr. McElroy, in view of what he says of the cost of cannel in Montreal, to apply to Mr. George R. Tuttle of Cleveland, Ohio, for a supply of his "Sterling cannel," a coal which yielded us over 47 per cent. of volatile matter, with a pretty fair coke. It ought to be delivered in Montreal cheaply enough.

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The attention of Architects, Engineers, Owners, Builders, Gas and Water Companies, is respectfully called to this importation. 252

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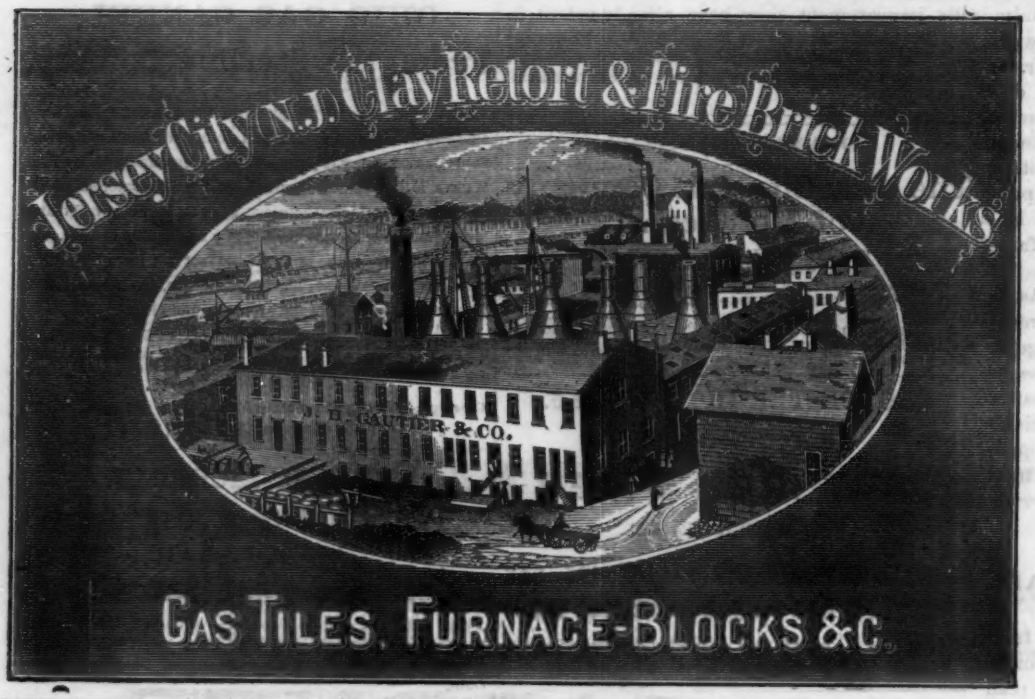

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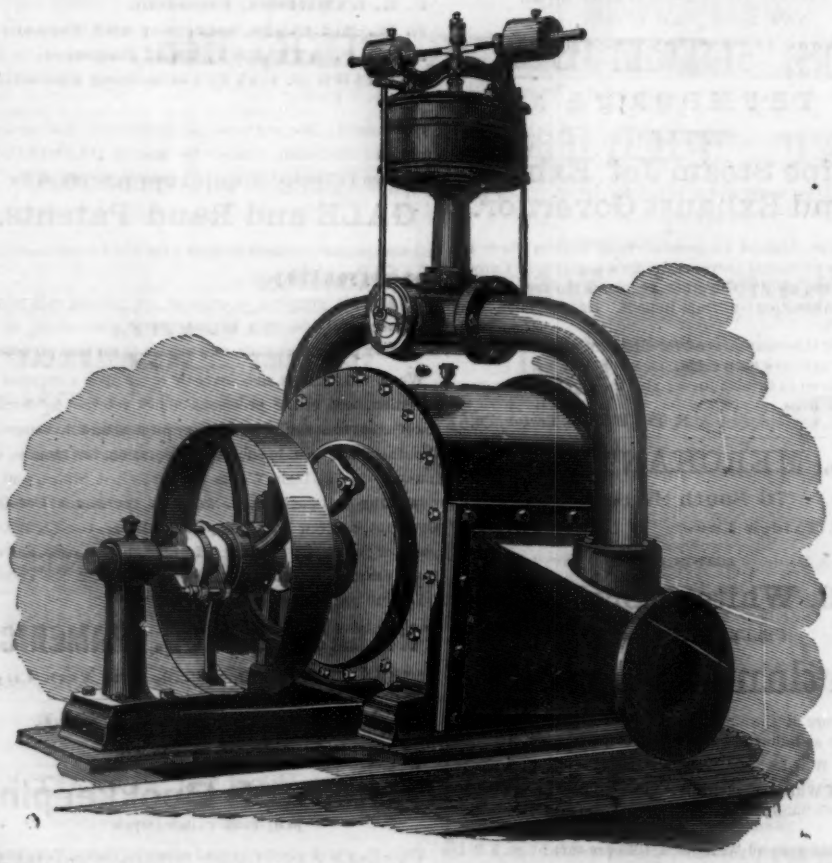

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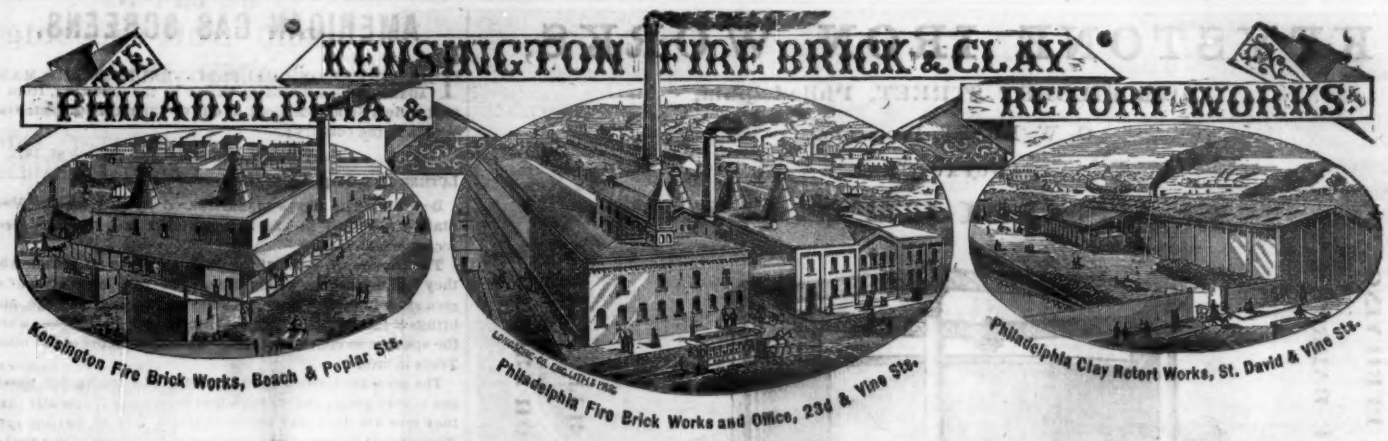
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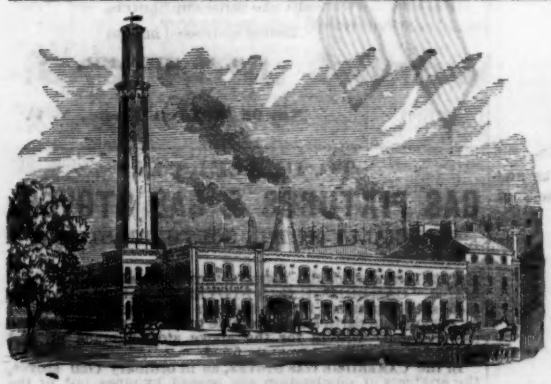

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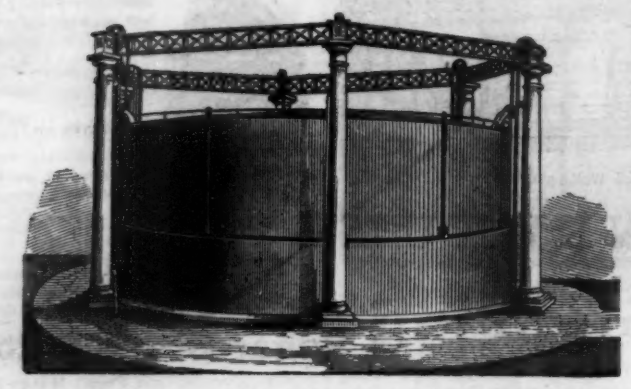

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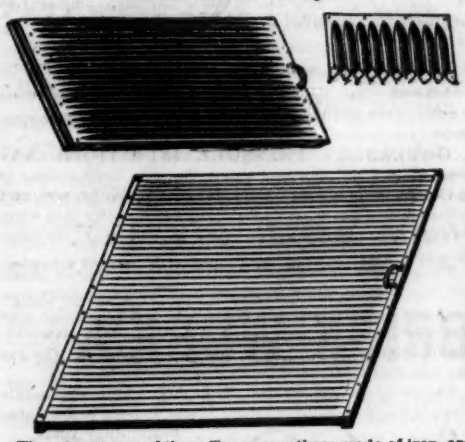

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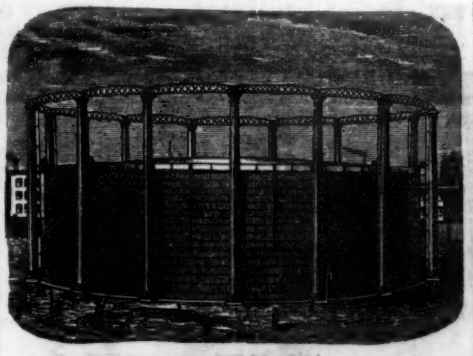

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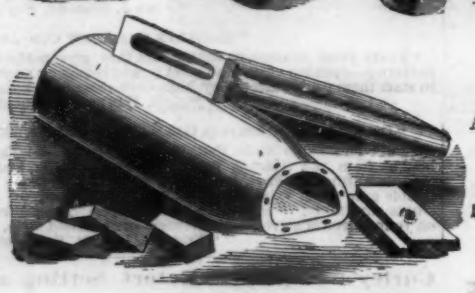

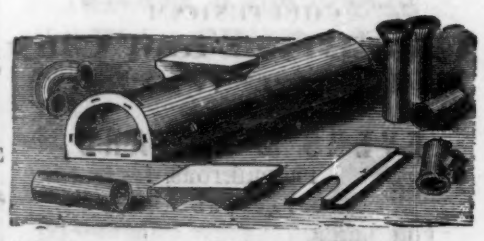

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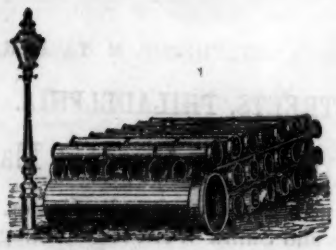

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Gas Apparatus,

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Air and Immersed Tubular Condensers,

Improved Dry Scrubbers,

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and every description of apparatus necessary for large or small Gas Works.

The designs for our apparatus are furnished by JAMES H. WALKER, Engineer and Superintendent Milwaukee Gas Works, who can be consulted on all matters relating to the working, erection of new, or extension of old works.

Parties employing us will find their orders promptly attended to, and satisfaction guaranteed in all cases.

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PIG IRON & CAST IRON GAS & WATER PIPES.

Also, Heay and Light Castings of every description.

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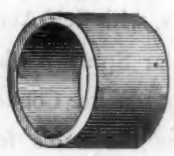

FIG. 2.

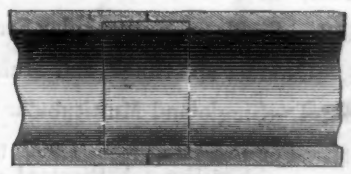

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3—Horizontal Section and Connection.

Above is a cut of the

"WYCKOFF PATENT IMPERISHABLE GAS PIPE,"

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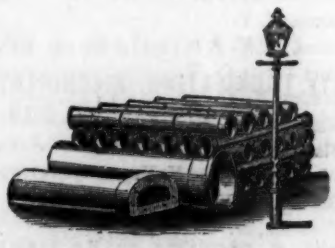

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STOP VALVES, from 3 to 30 inches, for both Water and Gas.

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